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CHANGES IN MOTOR VEHICLE BUYER ATTITUDES AND MARKET BEHAVIOR

COMPLETED
ORIGINAL

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FINAL REPORT

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16. Abstract

An analysis is made of the impact of fuel efficient motor vehicle design changes on the attitudes and market behavior of buyers of new motor vehicles over time. Car buyer profiles are prepared describing by make, demographic characteristics, owner satisfaction, reasons for buying, car characteristics, source of sales, and owner loyalty. The truck profiles include demographic characteristics, characteristics of new vehicle purchased, other trucks and vans owned, alternate purchase decision, and vehicle useage. The analysis focuses on determining the statistically significant changes that occurred among buyers of specific makes when new fuel efficient designs are introduced and tracking their changes through time. The multivariate statistical technique of discriminate analysis is used to determine which vehicle attributes significantly distinguish new car buyers before a fuel economy design change from buyers of the same make after the design change. Positioning maps are prepared to examine how the positioning of the nine car segments in terms of similarities in car preferences and demographics has changed from the pre-downsizing baseline year of 1976 over the next three model years in which downsizing has occurred. Share of market, market composition, source of sales and owner loyalty are discussed. It is concluded that domestic manufacturers brought more fuel efficient vehicles to the market place in the model years 1977, 1978, and 1979 compared to the baseline year of 1976. These more fuel efficient vehicles have been well received and there has been no major distortion of buyer attitudes or segment positioning.

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PREFACE

To meet the requirements of the automobile market and the legislated motor vehicle fuel economy requirements, there have been major changes in the design of U.S.-built motor vehicles. This study assesses the changes in motor vehicle buyer attitudes and market behavior with respect to these design changes. Specifically, the objectives of this study have been defined as follows:

(a) To make an assessment of the changes in the attitudes and market behavior of new motor vehicle buyers from Model Years 1976 through 1979.

(b) To evaluate the impact of fuel efficient motor vehicle designs on the attitudes and market behavior of new motor vehicle buyers during the same model years.

The study was performed under Contract DOT-TSC-1720, which is part of the Transportation System Center's "Support for Research and Analysis in Automotive Fuel Economy and Related Areas -- Consumer Preference, Attitudes and Perception" Task A. This work was sponsored by the National Highway traffic Safety Administration, under PPA HS-927 and PPA HS-063.

The multivariate analysis was performed by Dr. Paul E. Green, S.S. Kresge Professor of Marketing, Wharton School, University of Pennsylvania.

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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares ($10,000 m^2$)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

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1. STUDY DESCRIPTION

1.1 BACKGROUND

On December 27, 1975 the Energy and Conservation Act of 1975 (P. L. 94-163) became law. Title III, Part A, of the Act amended the Motor Vehicle Information and Cost Savings Act (P. L. 92-513) by adding Title V aimed at improving the fuel efficiency of motor vehicles through enforcement of fuel standards for specific model years -- 18 miles per gallon (MPG) for model year 1978, 19 MPG for 1979, 20 MPG for 1980, and 27.5 MPG by 1985. Average fuel economy standards for light trucks rated at less than 6001 gross vehicle weight (GVW) were set at 17.2 MPG for 1979 light duty vehicles and 15.8 MPG for general utility vehicles. 1980 standards for light trucks rated at less than 8501 GVW were set at 16 MPG for 2-wheel drive vehicles and 14 MPG for 4-wheel drive vehicles. 1981 standards were established at 16.7 MPG for 2-wheel drive and 15.0 MPG for 4-wheel drive.

1.2 AUTO MANUFACTURERS' RESPONSES TO FUEL ECONOMY STANDARDS

Well before enactment of the Energy Act of 1975, and even before the oil embargo of late 1973, the automotive industry was examining the probable impact of a growing energy problem on the automotive industry. In April of 1973, almost three years before fuel economy standards became law, formal plans were initiated at General Motors to downsize the 1977 model year full size cars to achieve a weight reduction of about 400 pounds to improve fuel economy by about one mile per gallon of fuel. These plans were augmented in December 1973 when General Motors decided on further reductions for the 1977 full size cars to be followed by downsizing the intermediate size cars in the 1978 model year and to continue downsizing other body sizes in each subsequent model year.

Forward product planning aimed at fuel economy improvement was slower to take shape at the other domestic manufacturers. Strategies and timing differed among manufacturers, but the major design alternatives were being investigated by all manufacturers. Among the various design options to increase fuel economy, the most obvious were weight reduction and improved automotive technology.

Weight reduction opportunities were apparent in two areas -- size reduction and materials substitution. Size reduction options included reducing vehicle dimensions (overall length, width, height) and reducing the gauge or thickness of current materials. For example, making glass windows thinner while still meeting federal safety standards has cut up to 25 pounds from the weight.

Weight reduction through materials substitution has spurred technological advancement in other materials. There is an increased use of plastics, aluminum and other lighter materials in accessories and exterior body components. The industry estimates that by the 1981 model year, one-third of the cars will have elastomeric reaction injected materials (RIM) as components of bumper systems. A fiberglass reinforced version of RIM (RRIM) may result in urethane fenders that are expected to be in some production programs in the 1982 model year. Because these and other parts are lighter, the size and weight of frames, suspensions, engines, and transmissions can also be reduced.

Simultaneously with weight reduction through size reduction and materials substitution, emphasis is being placed on improved automotive technology. The industry is exploring improved aerodynamic designs, improved transmission, engine types, tires, type of fuel, electronic metering and other means of reducing fuel consumption.

In total, the automotive industry is engaged in the most massive product redesign in its history. A whole new generation of cars and light trucks is being designed at an expenditure level of between $1 and $2 billion for each mile per gallon improvement in Corporate Average Fuel Economy between now and 1985.

However, there is a considerable difference between domestic manufacturers in the pace with which these changes are taking place. General Motors started sooner and moved faster than the rest of the domestic manufacturers. In 1973 GM established its first Project Center (PC) organized specifically to downsize the full size standards (B and C-body cars) for the 1977 model year. Subsequently the same management approach (PC's) was employed to scale down the intermediates (A-body and A-specials) for the 1978 model year. Next, the E-bodies (Eldorado, Toronado and Riviera) were downsized in the 1979 model year and a diesel engine option was made available on Oldsmobile Cutlass and all Cadillacs. The all new compact X-body cars were introduced in April of 1979 as 1980 model year cars.

Ford Motor Company's downsized cars were slower to enter the market. The Ford Thunderbird was repositioned in the 1977 model year from a large specialty luxury segment car to an intermediate segment car, priced $2,700 below the 1976 Thunderbird. But, it was not until the 1979 model year that the first major Ford Motor Company downsized cars entered the market with the 1979 Mercury Marquis, about 800 pounds lighter, and the Ford, about 650 pounds lighter, than their predecessors. A third generation Mustang (Mustang II), about four inches longer, but 180 pounds lighter than the 1978 model, also made its appearance in the 1979 model year.

Chrysler introduced the Plymouth Horizon and the Dodge Omni (the first U. S. made front-wheel drive subcompacts) in the 1978 model year and downsized the Chrysler New Yorker and Chrysler Newport, in the 1979 model year.

Wheelbase, overall length, width, height, and curb weight specifications before and after downsizing are shown by make and model year in Appendix Tables 1-1 through 1-4. Table 1-5 shows the average miles per gallon as reported by owners before and after downsizing, reflecting the improved MPG for each downsized make. Tables 1-6 shows the number of units produced in each segment by each domestic manufacturer.

1.3 INFORMATION NEEDS OF THE NATIONAL HIGHWAY TRAFFIC ADMINISTRATION (NHTSA).

Title V requires that the administrator, NHTSA, consider the "economic practicability" of the automobile fuel efficiency regulations. To this end, the federal government has previously determined that it is technologically feasible for manufacturers to meet the mandated fuel economy standards and that household savings resulting from reduced motor fuel expenditures will exceed fuel economy related price increases in cars and light trucks. Office of the Secretary, U. S. Department of Transportation, The Report by the Federal Task Force on Motor Vehicle Goals Beyond 1980, (Washington, 1976) and U. S. Department of Transportation, Rulemaking Support Paper Concerning the 1981 - 1984 Passenger Auto Average Fuel Economy Standards, (Washington, 1977).

However, there are other aspects to be reckoned with in considering "economic practicability". A product could be a technological success (in that it meets the target set of standards), but fail in the market place. Consequently, in considering the "economic practicability", one of the concerns is that although satisfying mandated standards, the changes in automobile and truck designs may lead to changes in consumer attitudes and market behavior which could have a negative impact on new vehicle sales. This in turn could cause serious dislocations in a major industry.

Over the years, a number of widely held beliefs have emerged describing consumer attitudes toward specific makes and describing the composition of the market in terms of specific segments. The segment definition employed by the industry consists of grouping together cars that are similar in size, price, and target market. As it turns out, attitudinal, behavioral, and demographic segmentation corresponds closely to the industry market segmentation.

The segments are well defined, with within-group differences being less than between-group differences. It is generally accepted, for example, that owners of small economy cars will differ in attitudes, behavior, and demographics from owners of larger more luxurious cars.

It follows that vehicle characteristics that are important enough to be purchase determinants in a particular segment, may be of minor importance to buyers in another segment. By the same token, a typical buyer in one segment may be willing to give up a higher level of one attribute -- for example, size, or comfort to gain a higher level of another attribute (fuel economy). The reverse could be true for the typical buyer in another segment.

The possibility that the steps taken or contemplated to achieve higher fuel economy may result in lower levels of other vehicle attributes important enough to the typical buyer to lead to market rejection is a matter of concern to NHTSA. Since design changes have taken place in different segments over three model years to date (1977, 1978, and 1979), NHTSA seeks to assess the impact of motor vehicle design changes on new vehicle buyer attitudes and buying behavior over time.

1.4 STUDY OBJECTIVES

Specifically, the objectives of this study have been defined as follows:

a. To make an assessment of the changes in the attitudes and market behavior of new motor vehicle buyers over time.

b. To evaluate the impact of fuel efficient motor vehicle designs on the attitudes and market behavior of new motor vehicle buyers.

These objectives are to be achieved by performance of the tasks specified by Contract DOT-TSC-1720. These tasks include preparation of buyer profiles of the model year 1976, 1977, 1978, and 1979 passenger car market, and the 1976, 1978 and 1979 light truck market. The car buyer profiles are described by make, demographic characteristics, owner satisfaction, reasons for buying, car characteristics, source of sales, and owner loyalty. The truck profiles include demographic characteristics, characteristics of new vehicle purchased, other trucks and vans owned, alternate purchase decisions and vehicle usage.

The analytical task is to analyze these data for statistically significant changes in attitudes and market behavior as related to changes in vehicle design. Specifically excluded is the analysis of the downsizing of the 1977 GM standard cars since this analysis was performed previously under another contract.

1.5 SOURCE OF DATA

The data source for this study is a proprietary data bank of 101,948 buyers of 1976, 1977, 1978, and 1979 model year passenger car buyers and 24,401 buyers of 1976, 1978, and 1979 light truck buyers previously assembled by Rogers National Research from a national probability sample of all domestic and high volume import makes.

Car buyers were sampled in the second quarter of each model year with approximately equal number of January, February and March buyers for each make. The truck sample was drawn from October and November buyers of each model year.

Detailed buyer profiles drawn from the Rogers National Research proprietary data bank have been delivered in separate volumes under the Data Use Restriction Provisisions. All the data in the proprietary data bank was accessed for the analysis in this report which is delivered without a data use restriction.

1.6 METHODOLOGY

The analysis that follows in Chapter 2 focuses on determining the statistically significant changes that occurred among buyers of specific makes when new fuel efficient passenger car designs were introduced. The multivariate statistical technique of discriminant analysis is used to determine which of 32 car attribute preference, evaluative rating, fuel economy, and respondent demographic variables significantly distinguish new car buyers before a fuel economy design change of a specific make from buyers of the same make after the design change.

An analysis of passenger car segment positioning is reported in Chapter 3. This analysis determines the positioning of the nine car segments in terms of similarities in car preferences and demographics and examines how this positioning has changed from the pre-downsizing baseline year of 1976 over the next three model years in which downsizing has occurred.

Chapter 4 examines buyer behavior and changes in market composition. Source of sales, conquest sales, owner loyalty and repurchase loyalty are reviewed.

Chapter 5 provides an overall summary and suggests the need to study the developing confrontations in the small car segments in the 1980 model year with the introduction of the General Motors' "X" Body cars and the scheduled introduction in the 1981 model year of Chrysler's downsized "K" Body cars, Ford Motor Company's new subcompact replacements for the Pinto and Bobcat, and General Motors' new "J" Body cars.

2. SUMMARY OF MULTIVARIATE ANALYSES

2.1 MAJOR FUEL EFFICIENCY DESIGN CHANGES

As already described, the first major downsizing of new cars appeared in the 1977 model year in which GM downsized its standard-sized cars (B and C body styles).

In the 1978 model year, GM downsized its intermediate size cars (A body and A body specials). The following were downsized:

General Motors	
Malibu	Cutlass Salon
Monte Carlo	Cutlass Supreme
LeMans	Century
Grand Prix	Regal

In the 1979 model year, GM downsized its E body cars, while Ford Motor Company downsized its standard size cars and Chrysler Corporation its two Chrysler Division standard size cars. Specifically the following makes were downsized in the 1979 model year.

General Motors	Ford Motor Company	Chrysler Corporation
Riviera	Ford LTD	Chrysler Newport
Toronado	Mercury	Chrysler New Yorker
Eldorado		

In addition to downsizing, in the 1978 model year optional turbo engines were offered in the Buick Regal and LeSabre, and optional diesel engines were offered in the Oldsmobile 88 and 98. GM expanded its optional turbo engines and diesel engine offerings in the 1979 model year by making the turbo engines available in the Century, Regal, LeSabre, and Toronado. Optional diesel engines were available in the 1979 model year in the Oldsmobile Cutlass, 88, 98, and Toronado; and the Cadillac Seville and Eldorado.

Further, compact pickup trucks (and related utility vehicles) achieved greater prominence in the 1978 and 1979 model years. GM also offered an optional diesel engine on its 1979 C-10 pickup.

2.2 OBJECTIVES

The primary objective of this chapter is to summarize the findings of these various fuel-efficient activities on new car buyers' attitudes, experiences, and demographics.

In all comparisons the multivariate statistical technique of discriminant analysis is used. In most cases, two groups are compared -- e.g., new car buyers of a specific model before downsizing versus those buying the model after downsizing. Discriminant analysis enables the researcher to determine which variables are significant in distinguishing between the a priori defined groups and, in addition, how well one is able to properly classify each individual car buyer.

We first discuss the study findings involving passenger cars. We then comment on a set of similar analyses for trucks and utility vehicles.

2.3 PASSENGER CAR DOWNSIZING

Appendix Table 2-1 shows a list of the 32 variables used in each discriminant analysis. As can be noted, four categories of variables are included -- car attribute preferences, evaluative ratings, fuel economy, and respondent background variables (vehicle ownership and demographics). Of course, in any specific analysis only a subset of these variables generally turns out to be significant (at the 0.05 significance level or better).

At this point, the research questions of interest are:

1. In what ways have specific downsizing activities affected
   a. Car attribute preferences?
   b. Car feature evaluations?
   c. Fuel economy?
   d. The demographic composition of buyers attracted to downsized cars?

2. What are the significant variables -- within each comparison and across all individual comparisons?

3. How accurate is the discriminant analysis in classifying buyers of downsized versus non-downsized cars?

4. On a <u>trend</u> basis, how have the discriminating variables behaved in subsequent years, following the initial downsizing year?

To answer the first three questions, 13 separate two-group discriminant analyses were conducted. The separate summary findings appear in Appendix Tables 2-2 through 2-14. The fourth question was addressed by a series of trend analyses, whose summary findings appear in Tables 2-15 through 2-18.

Illustratively, let us first examine Table 2-2. This table compares buyers of the 1978 (downsized) Century with buyers of the 1977 (non-downsized) Century. Only those variables that are statistically significant are shown. Thus, out of the 32 potentially significant variables, only 18 are significant in this case.

Illustratively, we note from Table 2-2 that buyers of the downsized Century choose models:

- With fewer cylinders and a lower incidence of power brakes, power steering, and air conditioning
- That are rated well on roominess, but poorly on styling, smoothness of transmission, and reliability
- That deliver better gas mileage -- city and highway

Moreover, buyers of the downsized Century tend to show:

- A higher ownership of trucks per household
- A higher proportion of married, with higher education and income
- A lower number of wage earners per household and a lower probability of residing in metropolitan areas.

We also note from Table 2-2 that the full set of significant variables correctly classifies 87 percent of the cases in the sample.

Each of the summaries in Table 2-3 through 2-14 is interpreted in the same way as described above. However, rather than making a detailed table-by-table interpretation, we have summarized the principal trends that are revealed by these specific downsizing events.

2.4 SUMMARY OF SPECIFIC DOWNSIZING EVENTS

A total of 13 specific downsizing events are covered in Tables 2.2 through 2.14.

In terms of the full set of downsizing events, we observe the following:

1. Physical Characteristics
   a. The average number of cylinders in downsized cars drops about 0.5.
   b. The percentage purchasing automatic transmission, power brakes, power steering, and air conditioning is lower for downsized cars:
      Auto transmission -- a drop of 6% to 36%
      Power brakes -- a drop of 5% to 59%
      Power steering -- a drop of 2% to 51%
      Air conditioning -- a drop of 1% to 36%

2. Fuel Economy
   a. In all cases fuel economy for both city and highway driving <u>increases</u>
      City driving -- an increase of 1.0 to 3.0 MPG
      Highway driving -- an increase of 1.1 to 3.5 MPG
   b. A greater percentage of downsized car buyers state that mileage was better than expected -- 23% versus 10%.

3. Reasons for Buying
   a. On the average, 9% of downsized car buyers list <u>pickup</u> as a major reason for buying (versus 3% of non-downsized car buyers).
   b. On the average, 28% of downsized car buyers list <u>mileage</u> as a major reason for buying (versus 8% of non-downsized car buyers).

4. Evaluative Ratings
   a. Buyers of downsized cars generally rate their cars higher on:
      Roominess
      Reliability
      Ease of starting
      than buyers of non-downsized cars.
   b. Buyers of downsized cars generally rate their cars lower on:
      Size/weight
      Smoothness of transmission
   c. Attribute rating in which a mixed pattern emerges are:
      Overall satisfaction
      Exterior styling
      Interior styling
      Value for money

5. Demographics
   a. Buyers of downsized cars exhibit the following pattern:
      i) Higher percent married -- 81% versus 68% (for non-downsized car buyers)
      ii) Older -- 42.7 years versus 36.8 years
      iii) Higher education -- 14.4 years versus 13.7 years
      iv) Higher percentage of management, technical, professional occupations -- 32% versus 23%
      v) Lower number of wage earners per household -- 0.9 versus 1.4 persons
      vi) Ownership of a greater number of cars -- 2.0 versus 1.7 cars
      vii) Ownership of a greater number of trucks -- 0.5 versus 0.2 trucks
   b. Mixed patterns
      i) No strong relationship is found between sex, head of household, family size, and size of locale versus purchase of a downsized car
      ii) While income levels for buyers of downsized cars were higher, this is confounded by year-to-year increases in inflation. However, on balance, increases in income are positively associated with the purchase of downsized cars.

In summary, we note that buyers of downsized cars achieve economy in various ways -- e.g., by purchasing fewer gas-consuming options, such as automatic transmission, power brakes, power steering, and air conditioning. Buyers of downsized cars also list mileage as a major reason for model selection and display higher evaluations for car roominess.

Furthermore, buyers of downsized cars tend to be older, with higher education, income, and with occupations that are drawn from the management, technical, and professional categories. They also currently own a large number of cars and trucks. In short, the initial buyers of downsized cars represent an "up-scale" innovative segment.

2.5 TREND ANALYSIS IN DOWNSIZING

As stated at the beginning of this chapter, the first major downsizing occurred in the 1977 model year when General Motors downsized its standard-sized cars. Accordingly, if one were to track some illustrative makes in the B and C body style classes, one could see if the differences noted in the first downsized model year (1977) continue to persist during subsequent model years, namely 1978 and 1979.

This comparison was carried out separately for the Chevrolet Caprice and the Oldsmobile 88; 98. Results appear in Tables 2-15 and 2-16. Discriminant analysis was again used in these cases; however, in the present analysis, each model year was compared separately to the base (pre-downsized) model year of 1976.

We first examine Table 2-15, describing the trend data for Chevrolet Caprice. The primary question of interest is: after downsizing has occurred for a year or two, is there some tendency for later buyers to be more like buyers of the pre-downsized model than initial buyers of the downsized model?

Table 2-15 suggests that such may be the case. First we ignore the fuel economy and income trends since these reflect the operation of independent factors (namely, technical advances in gas mileage and inflation).

However, when we examine the evaluative ratings, the ratings in the 1979 model year tend to be closer to those in the 1976 model year than are the 1977 model ratings.

Additional support for this finding is noted in the case of number of cars in household, percentage whose occupation is managerial, professional, or technical, and education. The differences are not striking, however. Moreover, in some cases -- education, age -- the peak values occur in the 1978 model year rather than the initial model year (1977) of downsizing.

Table 2-16, summarizing the counterpart findings for the Oldsmobile 88; 98 shows broadly similar results, including some of the same ambiguities in which the 1978 model year (rather than 1977) shows the highest values for number of cars in household and education.

As indicated at the beginning of this chapter, in the 1978 model year General Motors downsized its A body and A body specials (intermediate size cars). Illustrative of those body styles are the Chevrolet Malibu and the Oldsmobile Cutlass Supreme. In this case we have only two comparison years -- 1979 and 1978 versus the pre-downsizing model year of 1977. Tables 2-17 and 2-18 summarize these results.

We first examine Table 2-17, summarizing the Malibu findings. There is some indication that number of cylinders, incidence of power brakes and air conditioning (and most of the evaluative ratings) reported by the 1979 model buyers are closer to the 1977 model buyers' responses than those of the initial (1978) adopters of the downsized models. This is also borne out by number of cars in household, number of trucks in household, and percent whose occupation is managerial, professional, technical. The differences are not striking, however.

Table 2-18, listing comparable data for the Oldsmobile Cutlass Supreme, shows broadly similar findings in the case of education and occupation. However, the pattern is mixed in the case of the evaluative ratings.

Taking all four analyses into consideration, there is some indication that the demographic characteristics:

Higher education
Higher percentage of management, technical, or professional occupation
Ownership of a greater number of cars/trucks

that are associated with early adopters of the downsized models become attenuated in subsequent model years as the innovation "laggers" enter the market. In any case, the differences are not all that striking, although they appear rather consistent across several different makes.

2.6 GASOLINE VERSUS DIESEL ENGINE SELECTION

In the 1979 model year GM offered the diesel as an optional engine on the Oldsmobile Cutlass Salon, Supreme, 88/98, Toronado, the Cadillac Eldorado and Seville.

Appendix Table 2-19 shows a summary of the two-group discriminant analysis regarding choosers of the diesel versus gasoline engine.

As noted from Table 2-19, diesel engine buyers:

1. Report higher fuel economy of approximately 5 MPG and indicate that the mileage was better than expected.
2. Rate their car worse on smoothness of transmission.
3. Exhibit a higher incidence of buying their car for its pickup.

In terms of demographics, diesel engine buyers:

1. Show a higher incidence of males, married, and heads of households.
2. Represent an older segment of the population.

In short, diesel engine selection, in the case of luxury cars, tends to run counter to the innovative sterotype of youth, mobility, etc.

2.7 PICKUP TRUCK COMPARISONS

Similar kinds of comparisons were also carried out for pickup trucks. Specifically, the following research questions were first raised:

1. How do buyers of 1978 full size pickup trucks differ from buyers of compact pickups?
2. How do buyers of 1979 full size pickup trucks differ from buyers of compact pickups?
3. How do buyers of 1979 full size pickup trucks differ from buyers of 1978 full size pickups?
4. Are differences noted between diesel versus gasoline engine selection in the case of 1979 Chevrolet C-10 pickup truck buyers?

Appendix Table 2-20 lists the set of predictor variables that were used in this part of the analysis. Tables 2-21 through 2-23 show individual discriminant analysis summaries, associated with the preceding research questions.

The findings of this part of the analysis can be summarized as follows:

1. Full size truck buyers display higher business use and rate their vehicle better on roominess.
2. Compact truck buyers rate their vehicle better on ease of starting when cold and smoothness of transmission.
3. Compact pickup buyers average about 11 miles per gallon more than full size buyers.
4. Compact buyers exhibit a lower proportion of males and married. Compact buyers are younger, better educated, and are drawn more from the managerial, professional, technical, and white collar occupations.

Next, we note from Table 2-23 that buyers of 1979 full size trucks show few differences, when compared to 1978 full size truck buyers:

1. Ratings on interior style, ease of starting when cold, and roominess are a little worse in the case of 1979 full size truck buyers.
2. However, for the most part, no major differences appear. In particular, miles per gallon is not shown to differ significantly between the two years.

Finally, from Table 2-24 we observe that diesel engine selectors (in the 1979 Chrevolet C-10 purchase group) differ significantly from gasoline engine selectors:

1. Diesel buyers exhibit a greater incidence of business use and rate their truck better on ease of handling.
2. Diesel buyers report fuel economies that average about 5 miles per gallon more than that shown by the gasoline engine buyers.
3. Diesel buyers are older, with higher incomes and exhibit a higher incidence of males.

2.8 ADDITIONAL ANALYSES OF THE TRUCK AND UTILITY VEHICLE MARKET

In addition to the preceding analyses of 1978 to 1979 pickup trucks, six more two-group discriminant analyses were run involving:

1. Demographic differences among buyers of cargo vans, passenger vans, and utility vehicles -- 1978 and 1979 models, separately.
2. Differences in vehicle usage and demographics between buyers of Class 1 (under 8500 pounds) vehicles versus Class II (over 8500 pounds) vehicles -- 1978 and 1979 models, separately.
3. Differences in usage and demographics between buyers of four-wheel vehicles versus two-wheel drive vehicles -- 1978 and 1979 models, separately.

The results of these analyses appear in Appendix Tables 2-25 through 2-30.

The findings of these comparisons can be summarized as follows:

1. Buyers of passenger vans (versus cargo vans and utility vehicles) show a higher incidence of marrieds with larger family size. They also tend to be older and more highly educated. In the case of 1979 model buyers, a very high proportion are drawn from the managerial, professional, and technical occupations.

2. Buyers of heavier (Class II) vehicles:
   a. Tend to use the vehicle for business, such as delivery, construction, repair, agriculture, and trade.
   b. Show a higher incidence of trailer pulling usage.
   c. Are older.

   while buyers of the lighter vehicles tend to use the vehicle for pleasure, including outdoor recreation. Moreover, buyers of the lighter vehicles perceive that the passenger carrying capacity is too small.

3. Buyers of four-wheel drive vehicles:
   a. Tend to use the vehicle for outdoor recreation, farming, and off-road travel.
   b. Are younger with a higher incidence of singles, lower education, and higher incomes.

   while buyers of two-wheel drive vehicles think that the vehicle's passenger carrying capacity is too small.

Finally, no major trends in these comparisons appear between the 1978 and 1979 models.

2.9 OVERALL SUMMARY

Insofar as the full set of passenger car and truck, van, and utility vehicle analyses are concerned, the following summary comments are pertinent:

1. Buyers of downsized cars exhibit a lower purchase incidence of automatic transmission, power brakes, power steering and air conditioning.

2. Fuel economy of downsized cars shows improvements of 1.0 to 3.0 MPG, compared to non-downsized cars; moreover, a greater percentage of downsized car buyers indicate that the mileage is greater than they expected to get.

3. Mileage and pickup are stated as reasons for buying by a greater proportion of downsized car buyers.

4. Downsized cars are generally rated better on:
   a. Roominess
   b. Reliability
   c. Ease of starting

5. Downsized cars are generally rated worse on:
   a. Size/weight desirability
   b. Smoothness of transmission

6. Demographics -- downsized car buyers are:
    a. More likely to be married
    b. Older
    c. More highly educated
    d. More likely to be from the management, technical, and professional occupations
    e. From households with fewer wage earners
    f. From households with a larger inventory of current cars and trucks
    g. From households with higher incomes (after adjustment for inflation)

7. However, there is some evidence to suggest that the demographic characteristics associated with early adopters of downsized models are not maintained in subsequent downsized model years. That is, later adopters ("laggers") tend to be more like buyers of the pre-downsized cars, with respect to education, percentage drawn from the management, technical, professional occupations, and ownership of cars/trucks.

8. Buyers of full size pickups show significant differences when compared to buyers of compact pickups.

9. Buyers of full size pickups:
    a. Display higher business use
    b. Rate their truck higher on roominess

10. Buyers of compact pickups:
    a. Rate their truck higher on ease of starting when cold and smoothness of transmission
    b. Obtain about 11 MPG more than the full size pickup buyer
    c. Are less likely to be male and married, are younger, better educated, and drawn from the managerial, professional, technical, and white collar occupations.

11. Buyers of full size pickups between 1978 and 1979 show very similar preference and demographic patterns.

12. Buyers of passenger vans (versus cargo vans or utility vehicles) are more likely to be married, older, more highly educated, with larger families, and drawn from the managerial, professional, and technical occupations.

13. Buyers of Class II vehicles (over 8500 pounds) tend to use the vehicle for business and hauling. They are also older than buyers of Class I vehicles.

14. Buyers of four-wheel drive vehicles use the vehicle for outdoor recreation, farming, and off-road travel. They are also younger, with lower eduation and lower incidence of being married, but with higher incomes.

15. Insofar as selectors of diesel versus gasoline-powered cars are concerned, diesel buyers:
    a. Report 5 MPG higher fuel economy
    b. Rate their car worse on smoothness of transmission
    c. Indicate pickup as a principal reason for selecting their car
    d. Are more likely to be male, married, and head of household
    e. Are older.

16. Insofar as selectors of diesel versus gasoline-powered pickup trucks are concerned, diesel buyers:
    a. Report a greater incidence of business use
    b. Rate their truck higher on ease of handling
    c. Report about 5 MPG higher fuel economy
    d. Are more likely to be male, with higher incomes
    e. Are older.

17. Buyers of downsized vehicles indicate that interior roominess has not suffered, despite the downsizing.

18. Moreover, additional fuel economies have been achieved by the lower incidence of power options associated with downsized car purchase.

19. Buyers of downsized cars exhibit a classic pattern of innovation in the sense of being better educated and more likely to be drawn from the management, technical, and professional occupations. They also have a larger inventory of current cars/trucks and have higher incomes.

In sum, the preceding analyses tend to support classic innovation adoption theory, in which early adopters of fuel-efficient vehicles would be expected to be drawn from the younger, more highly educated, affluent, and professionally trained segments of the population. However, this anticipated behavior is not completely consistent; for example, in diesel engine selection the early adopters appear to be drawn from the older population segment, as is the case in most of the downsized passenger cars. In subsequent downsizing years the demographic differences between buyers of downsized cars and buyers of the pre-downsized models tend to narrow, so that "later adopters" show relatively small (or no) differences in demographic profiles, when compared to buyers of the pre-downsized models. Finally, the demographic profiles of even the early adopters -- while statistically significant -- reflect relatively small differences from a pragmatic viewpoint, when compared to buyers of the pre-downsized models.

3. ANALYSIS OF PASSENGER CAR SEGMENT POSITIONING

3.1 MAPPING METHODOLOGY

One of the advantages of multiple discriminant analysis is that the technique enables the researcher to construct "positioning maps" of the groups being compared. In the specific case of this study, information was available on the following market segments:

- Subcompact
- Small Specialty
- Low Price Compact
- Medium Price Compact
- Intermediate
- Intermediate Specialty
- Low Price Standard
- Medium Price Standard
- Luxury

This information consisted of the same 32 variables (see Table 2-1) analyzed earlier, at the individual car level.

Discriminant analysis finds linear combinations of the original variables that maximize the ratio of among-group variance to within-group variance. Each linear combination is "extracted" in such a way that the first combination results in the largest ratio, the second combination in the second largest ratio, and so on. Hence, if one plots discriminant scores of each group on (say) the first two linear combinations or dimensions, a positioning map can be obtained.

This technique was applied separately to the four model years -- 1976 through 1979. Our interest in carrying out this analysis was to see if downsizing strategies (beginning in the 1977 model year) were profound enough to upset the relationships among the nine segments listed above.

3.2 SEGMENT POSITIONING -- 1976 THROUGH 1979

Tables 3-1 through 3-4 show the similarities maps for model years 1976 through 1979, respectively. The mapping technique does not provide labels for the axes. These have to be supplied by the researcher on the basis of those original variables that correlate most highly with the discriminant axes.

In this case the interpretation of the first (horizontal) axis was easy. As noted in Table 3-1, this axis is a size-related axis that separates small cars, such as the subcompact, from large cars, such as the luxury and standard segments.

The vertical axis is somewhat more difficult to label. As noted in Table 3-1, this axis separates the luxury and subcompact segments from the rest. Clearly, these segments differ markedly in terms of car size. What do they display in common, so that the vertical axis distinguishes them from the other seven segments?

The answer is that certain demographic variables -- education level, income, and occupation, primarily -- distinguish the subcompact and luxury segments from the rest. Buyers of cars in these segments display higher formal education and tend to be drawn from the managerial/professional/technical occupations. They also tend to have higher incomes and own more cars per household.

3.3 CHANGES IN SEGMENT POSITIONING -- 1976 THROUGH 1979

As we examine each of the tables describing the model years, 1976 through 1979, it is remarkable how stable the market relationships are. Although various kinds of downsizing are taking place within each segment, the relationships across segments vary relatively little over the four model years.

The main change that occurs is in the 1979 model year in which the small specialty segment plots much closer to subcompact than in the other model years. This reflects differences in ratings on physical attributes as well as an increasing proportion of owners drawn from higher education levels and the managerial/professional/technical occupational groups.

3.4 SEGMENT POSITIONING SUMMARY

The most noteworthy finding of the positioning analysis is the stability of the relative positions across the nine segments over the four model years -- 1976 through 1979. The findings are summarized as follows:

1. The segment positions remain relatively the same before (1976) and after various downsizing events.
2. The first (horizontal) axis is interpreted as a size dimension while the second (vertical) axis is interpreted as an education/occupation/income dimension.
3. What can be seen is a splitting up of the higher educated groups into those who favor the luxury cars versus those who like the simplicity and "inconspicuous" characteristics of the subcompacts and small specialty car.
4. This result should be tempered, of course, by the fact that the data reflect multiple car ownership (i.e., the same household can own both a luxury and a subcompact or small specialty car).
5. While it is to be expected that within-segment changes reflect various downsizing events, the among-segment relationships remain quite similar across the four model years.

In sum, despite a number of major upheavals in the size, weight, and performance characteristics of passenger cars over the 1976 through 1979 model years, the market segments appear to have absorbed these shocks with little relative change in positioning.

Finally, it should be mentioned that all of the four two-dimensional solutions accounted for at least 82% of the total variance in the discriminant ratios; that is, each solution provided an excellent representation of the full discriminant analysis space.

4. BUYER BEHAVIOR

4.1 CHANGES IN MARKET COMPOSITION

The ultimate validation of the acceptance or rejection of product design changes comes from the market place. Traditionally, the automotive industry looks to share of market statistics by make, division, manufacturer, and segment to track changes in market composition. Although many market variables are operative simultaneously, some additional clues as to how downsizing influenced market behavior are developed by examining share of market statistics before and after downsizing.

Appendix Table 4-1 shows market share by segment, January through September for both the 1977 and 1978 model years. General Motors downsized its 1978 intermediates. To assess the impact on market composition, interest centers around the share of market obtained by the downsized 1978 GM intermediates compared to 1977 GM intermediates (before downsizing), relative to Ford Motor Company and Chrysler Corporation intermediates in both model years.

Appendix Table 4-2 shows share of market by make for the 1977 and 1978 model year intermediates. In total, General Motors' share of the intermediate segment increased marginally from 63.2% in the 1977 model year to 63.8% in the 1978 model year. Ford Motor Company's share of the intermediate market segment increased from 24.9% to 26.0%, while Chrysler Corporation's share dropped from 11.3% to 9.9%.

While these shifts in segment share are by no means conclusive evidence that the downsizing of the 1978 GM intermediates resulted in increased market penetration, it is clear that downsizing per se did not have a negative effect on GM's market share. It is interesting to note, however, that significant differences show up in execution.

Both the Buick Division and the Oldsmobile Division offered two distinctly different styling concepts in their 1978 intermediates. The Buick Division's Century featured "fastback" styling while its stable-mate, the Regal, featured "notchback" styling. The Oldsmobile Cutlass Salon was a "fastback" while its stable-mate, the Cutlass Supreme, was a "notchback". The "fastback" styling was not well accepted and both the Century and the Cutlass Salon suffered sharp declines with unit sales dropping more than 50% for both the Century and the Cutlass Salon. On the other hand, the "notchback" styling concept of both the Buick Regal and the Cutlass Supreme was well received with both makes showing an increase in unit sales and share of market. The Buick Regal share of market increased from 6.3% of the intermediate segment to 9.1%, while the Cutlass Supreme share increased from 13.7% to 15%.

Appendix Table 4-3 shows market share by segment for January through September 1978 and 1979. In the 1979 model year, Ford Motor Company downsized its standard size Ford and Mercury cars, Chrysler Corporation downsized its standard size Chrysler cars, and General Motors downsized its E-body cars (Buick Riviera, Oldsmobile Toronado, and Cadillac Eldorado).

Appendix Table 4-4 shows share of market in the standard size segment for the 1978 and 1979 models (January through September). General Motors, which gained market share in its first year of downsizing (1977), lost segment market share from 1978 to 1979. Ford Motor Company downsized the Ford LTD and the Mercury Marquis in 1979 and lost 1.2 percentage points share of segment. On the other hand, Chrysler Corporation downsized its Chrysler Newport which gained 2.2 percentage points and its Chrysler New Yorker which gained 0.1 percentage points. Chrysler also added a new downsized standard, the Dodge St. Regis, which obtained 2.0% of the segment. In total, Chrysler Corporation's share of the segment improved from 4.2% to 8.4%.

Table 4-5 shows market share in the luxury car segments for the 1978 and 1979 model year (January through September). The General Motors' E-body cars were downsized in 1979 and each downsized make showed significant gains in share of market - the Riviera from 3.3% to 9.0%, the Toronado from 3.9% to 8.3%, and the Eldorado from 7.4% to 10.9%.

4.2 SOURCE OF SALES

Source of sales is a description of the origin of the buyers of a particular make in terms of the previous car owning status of these buyers. Source of sales describes, in effect, where the business came from. The percentage base for source of sales is the total number of buyers of a particular make. The percentage distribution shows the origin of purchasers in terms of previous car owned, which is used for the percentage distribution regardless of whether the previous car owned was disposed of or kept.

The table below compares the source of sales of the 1978 downsized General Motors' intermediates and the pre-downsized 1977 General Motors' intermediates.

Previously Owned a Car Made By	Percent That Bought This Model Year GM Intermediates	
	1977	1978
American Motors	2.0%	2.5%
Chrysler Corporation	7.6	8.5
Ford Motor Company	15.5	15.5
General Motors Corporation	66.9	59.1
Imports	8.0	14.4
Total	100.0%	100.0%

Source of sales statistics provide a measure of "conquest sales" -- the extent to which sales of any given make are made to previous owners of competitive makes. Thus it can be seen from the above table that the 1978 downsized GM intermediates were more successful at conquest sales than their 1977 predecessors. About 41% of the 1978 GM intermediate sales were conquest sales compared to about 33% for the 1977 model year. It should be noted that GM's conquest sales increased 1.4 percentage points among other domestic makes, but increased by 6.4 percentage points among previous owners of import makes.

The downsized standards introduced by Ford Motor Company in the 1979 model year did not do as well in terms of conquest sales, showing a drop from 41% in the 1978 model year to 37% in the 1979 model year. The 1979 downsized Chrysler increased conquest sales to 31% from 29% for the 1978 model year.

A significant gain in conquest sales was achieved by the downsized GM 1979 E-body cars (Riviera, Toronado, and Eldorado). Conquest sales increased from 15% in the 1978 model year to 25% in the 1979 model year.

4.3 OWNER LOYALTY AND REPURCHASE LOYALTY

Owner Loyalty is another basic concept used to analyze trading patterns in the automotive industry. Under the owner loyalty definition, an owner of a specific make is considered loyal if he bought the same make as his previous car regardless of whether he retained or disposed of his previous car -- and regardless of whether his previous car was purchased new or used. Owner Loyalty is computed by accounting for the total number of owners of a specific make who entered the new car market in a specific period. It answers the question, "What makes were purchased by all the owners of a particular make who entered the new car market?" Contrary to source of sales (where the business came from), owner loyalty describes where the business went.

Repurchase Loyalty is a further refinement of owner loyalty. It is more precise in that it separates cars purchased new from cars purchased used when setting up the base to measure loyalty. The percentage base for Repurchase Loyalty is the total number of owners of a particular make which had been purchased new and was disposed of in the purchase of a new car in the specific period. The percentage distribution shows the makes of new cars purchased by owners of each car disposed of that had been purchased new.

Repurchase Loyalty could provide analytical clues to the extent that one could determine whether former owners of the same make selected the new downsized make or switched when they entered the market. Unfortunately, however, a massive sample of new car buyers of all makes is required to produce an adequate sample of owners disposing of low volume makes purchased new who entered the market for a new car in the period.

For example, the survey of 21,894 new car buyers of 104 domestic and import makes in the 1978 model year, produced only 51 Riviera buyers who traded in or disposed of a Riviera purchased new. The survey of 35,955 new car buyers who purchased in the 1979 model year, produced only 88 buyers who traded in or disposed of a Riviera purchased new. Because of small samples in the Repurchase Loyalty calculation, Grand Prix, Mercury, Riviera, Toronado, and Eldorado are not included in the table below which shows Repurchase Loyalty by make -- pre-downsized model year compared to downsized model year.

MAKE REPURCHASE LOYALTY

	1977 Pre-Downsized	1978 Downsized
Intermediate		
Malibu	21.5%	20.7%
Monte Carlo	24.2	24.5
LeMans	9.4	10.6
Cutlass/Cutlass Supreme	36.0	23.6
Century/Regal	26.8	20.3
Standard Size		
Ford	26.1%	31.0%
Chrysler	21.7	32.6

Examination of the above make Repurchase Loyalty reinforces the notion that the execution of the downsizing plays an important role in the acceptance of the downsizing by former owners of the same make. Among the intermediates, marginal differences appear -- Malibu down 0.8 percentage points, Monte Carlo up 0.3, and LeMans up 1.2. But Cutlass/Cutlass Supreme and Century/Regal show a completely different picture with both down sharply. This again reflects the rejection of the "fastback" styling of the Cutlass Salon and the Century.

Looking at the standard size segment, both the Ford LTD and the Chrysler Newport, downsized in the 1979 model year, showed significant increases in Repurchase Loyalty.

5. CONCLUSIONS

The car buying public is responding favorably to the initial round of downsizing by American automobile manufacturers. The first major downsizing (GM standard size cars in the 1977 model year) has been previously reported as a significant fuel economy measure and a success in the market place as well. (Report No's. DOT-TSC-NHTSA-78-38 "Study of Consumer Automotive Preference With Regard to Fuel Economy Measures", dated May 1978.)

Significant gains in fuel economy have also resulted from the downsizing of the 1978 GM intermediates. Chevelle/Malibu, for example, produced 346,276 units in the 1977 model run, averaging 13.80 MPG city and suburbs, 17.47 MPG highway. The 1978 downsized model run consisted of 377,819 units averaging 15.93 MPG city and suburbs (2.13 MPG improvement) and 19.76 MPG highway (2.29 MPG improvement). Total production of 1978 downsized GM intermediates was 1,821,642 - each with improved fuel economy compared to the 1977 models.

To a lesser extent because of lower sales volumes, the downsizing of the Ford and Chrysler standard size and the GM luxury personal cars in the 1979 model year also contributed to reduced fuel consumption over the previous year.

The multivariate statistical analysis in this study finds that the effect of the various fuel-efficient activities on new car buyers attitudes and experiences is generally favorable. Significant differences are found between the average attitudinal, behavioral and demographic profiles of the two a priori defined groups -- e.g., new car buyers of a specific make before downsizing versus those buying the model after downsizing.

The analysis finds that attributes related to fuel economy distinguish buyers of downsized cars from pre-downsized cars. To a significantly greater extent, buyers of downsized cars named better gas mileage as a major reason for buying. They reinforced the pursuit of better fuel economy by choosing smaller engines and having a lower incidence rate of automatic transmissions, power options, and air conditioning than buyers of non-downsized makes.

Buyers of downsized cars in the first year of downsizing rate their cars higher on roominess, reliability, and ease of starting, but lower on size/weight and smoothness of transmissions than buyers of non-downsized cars. Demographically they are older, more likely to be married, better educated, have higher incomes, are more likely to have management, technical and professional occupations, and generally represent an "up-scale" innovative segment.

After the first year following downsizing, however, these differences tend to diminish to the point that in subsequent model years after downsizing the later buyers tend to be more like buyers of the pre-downsized models. This being the case, the data indicates that downsizing has not alienated the traditional segment buyers.

Further, segment positioning maps found a very high stability of the relative position of the nine segments over the four model years -- 1976 through 1979, indicating that the major product design changes have not caused dislocations in the positioning of the segments.

Fuel economy design changes by American manufacturers have not resulted in major shifts in share of market among the domestic manufacturers. From the pre-downsizing baseline year of 1976 GM share of total U. S. registrations has declined less than one percentage point. American Motors has dropped 1.01 percentage points, Ford Motor Company lost 1.73 percentage points, and Chrysler Corporation had the biggest loss -- 3.37 percentage points. On the other hand, while all domestic makes experienced a decline in market share, the import share increased from 13.64% in 1976 to 20.47% in 1979, a gain of 6.83 percentage points (Table 4-6).

In summary we can conclude that domestic manufacturers have in fact brought vehicles that were more fuel efficient to the market place in the model years 1977, 1978, and 1979 compared to the baseline year of 1976. These more fuel efficient vehicles have been well received and there has been no major distortion of buyer attitudes or segment positioning.

In the market place, the major problem for U. S. manufacturers appears to be one of timing. U. S. downsizing started from the top down, and was out of phase with the more rapid shift of the escalating market demand for even smaller, more fuel efficient vehicles -- a demand that exceeded U. S. small car manufacturing capability. Imports increased their share of market penetration and are now accounting for almost 30 percent of the market. In the automotive bellwether state of California, imports are approaching 50 percent of the market.

GM's "X" body cars, designated as 1980 model year cars, were introduced in April 1979 and thus were not included in the Rogers National Research National Survey of Second Quarter Buyers (January, February and March). These compact cars (Citation, Phoenix, Omega, and Skylark) are selling in record numbers with customers placed on long waiting lists for delivery.

Catch-up opportunities for the domestic manufacturers in the rapidly expanding small car market are expected in the 1981 model year when GM will introduce its J-body cars as replacements for Monza and Sunbird, Ford will bring in its high-mileage subcompact replacements for the Pinto and Bobcat, and Chrysler will introduce its downsized K-body cars to replace the Plymouth Volare and Dodge Aspen.

TABLE 1-1

SPECIFICATIONS OF GENERAL MOTORS CORPORATION
1977 AND 1978 INTERMEDIATE SIZE CARS

	1977 (1) Pre-Downsized	1978 (2) Downsized	1978 ± 1977
Chevelle 6/Malibu V-6			
Wheelbase (in.)	112.0	108.1	- 3.9
Overall Length (in.)	205.7	192.7	- 13.0
Overall Width (in.)	77.3	71.5	- 5.8
Overall Height (in.)	53.4	54.2	+ 0.8
Curb Weight (lbs.)	3667	3113	- 554
Monte Carlo V-6			
Wheelbase (in.)	116.0	108.1	- 7.9
Overall Length (in.)	213.3	200.4	- 12.9
Overall Width (in.)	77.6	71.5	- 6.1
Overall Height (in.)	52.8	53.9	+ 1.1
Curb Weight (lbs.)	3968	3141	- 827
LeMans V-6			
Wheelbase (in.)	112.0	108.1	- 3.9
Overall Length (in.)	208.0	198.5	- 9.5
Overall Width (in.)	77.4	72.4	- 5.0
Overall Height (in.)	52.7	54.4	+ 1.7
Curb Weight (lbs.)	3666	3130	- 536
Grand Prix V-8			
Wheelbase (in.)	116.0	108.1	- 7.9
Overall Length (in.)	218.1	201.2	- 16.9
Overall Width (in.)	77.8	72.8	- 5.0
Overall Height (in.)	52.6	53.3	+ 0.7
Curb Weight (lbs.)	3939	3301	- 638
Cutlass Supreme V-8			
Wheelbase (in.)	116.0	108.1	- 7.9
Overall Length (in.)	215.2	197.7	- 17.5
Overall Width (in.)	76.7	71.9	- 4.8
Overall Height (in.)	54.1	53.4	- 0.7
Curb Weight (lbs.)	3913	3307	- 606
Century V-8			
Wheelbase (in.)	116.0	108.1	- 7.9
Overall Length (in.)	213.6	196.0	- 17.6
Overall Width (in.)	79.0	70.1	- 8.9
Overall Height (in.)	53.6	55.0	+ 1.4
Curb Weight (lbs.)	3899	3270	- 629

(1) Automotive News 1977 Market Data Book Issue April 27, 1977, p. 82

(2) Automotive News 1978 Market Data Book Issue April 26, 1978, p. 103

TABLE 1-2

SPECIFICATIONS OF GENERAL MOTORS CORPORATION

1978 AND 1979 "E" BODY CARS

	1978 (1) Pre-Downsized	1979 (2) Downsized	1979 ± 1978
Riviera V-8			
Wheelbase (in.)	115.9	114.0	- 1.9
Overall Length (in.)	218.2	206.6	- 11.6
Overall Width (in.)	77.2	70.4	- 6.8
Overall Height (in.)	55.0	54.3	- 0.7
Curb Weight (lbs.)	3891	3862	- 29
Toronado V-8			
Wheelbase (in.)	122.0	114.0	- 8.0
Overall Length (in.)	227.5	205.6	- 21.9
Overall Width (in.)	80.0	80.0	-
Overall Height (in.)	53.2	54.2	+ 1.0
Curb Weight (lbs.)	4767	3851	- 916
Eldorado V-8			
Wheelbase (in.)	126.3	113.9	- 12.4
Overall Length (in.)	224.0	204.0	- 20.0
Overall Width (in.)	79.8	71.4	- 8.4
Overall Height (in.)	54.2	54.2	-
Curb Weight (lbs.)	5052	3897	-1155

(1) Automotive News 1978 Market Data Book Issue April 26, 1978, P. 103

(2) Automotive News 1979 Market Data Book Issue April 25, 1979, P. 113

TABLE 1-3

SPECIFICATIONS OF FORD MOTOR COMPANY

1978 AND 1979 STANDARD SIZE MAKES

	1978 (1) Pre-Downsized	1979 (2) Downsized	1979 ± 1978
Ford 4-Door V-8			
Wheelbase (in.)	121.0	114.4	- 6.6
Overall Length (in.)	224.1	209.0	- 15.1
Overall Width (in.)	79.5	77.5	- 2.0
Overall Height (in.)	54.8	54.5	- 0.3
Curb Weight (lbs.)	4266	3611	- 655
Mercury 4-Door V-8			
Wheelbase (in.)	124.0	114.4	- 9.6
Overall Length (in.)	229.0	212.0	- 17.0
Overall Width (in.)	79.6	77.5	- 2.1
Overall Height (in.)	54.7	54.5	- 0.2
Curb Weight (lbs.)	4518	3707	- 811

(1) Automotive News 1978 Market Data Book Issue April 26, 1978, p. 104

(2) Automotive News 1979 Market Data Book Issue April 25, 1979, p. 114

TABLE 1-4

SPECIFICATIONS OF CHRYSLER CORPORATION

1978 AND 1979 STANDARD SIZE MAKES

	1978 (1) Pre-Downsized	1979 (2) Downsized	+ 1979 - 1978
Chrysler Newport V-8			
Wheelbase (in.)	123.9	118.5	- 5.4
Overall Length (in.)	227.1	221.5	- 5.6
Overall Width (in.)	79.5	77.1	- 2.4
Overall Height (in.)	54.7	54.5	- 0.2
Curb Weight (lbs.)	4603	3835	- 768
Chrysler New Yorker V-8			
Wheelbase (in.)	123.9	118.5	- 5.4
Overall Length (in.)	231.0	221.5	- 9.5
Overall Width (in.)	79.5	77.1	- 2.4
Overall Height (in.)	54.7	54.5	- 0.2
Curb Weight (lbs.)	4812	3835	- 977

(1) Automotive News 1978 Market Data Book Issue April 26, 1978, p. 102

(2) Automotive News 1979 Market Data Book Issue April 25, 1979, p. 113

TABLE 1-5

AVERAGE MILES PER GALLON
REPORTED BY OWNERS

	City and Suburbs		Highway	
INTERMEDIATE	1977	1978*	1977	1978*
Chevrolet Chevelle/Malibu	13.80	15.93	17.47	19.76
Chevrolet Monte Carlo	13.77	15.63	17.31	20.19
Buick Century	14.95	15.76	18.77	20.10
Pontiac Grand Prix	14.10	15.01	18.16	19.15
Pontiac LeMans	14.61	15.61	18.58	19.80
Oldsmobile Cutlass	14.72	16.33	18.58	20.59

	City and Suburbs		Highway	
	1978	1979*	1978	1979*
STANDARD SIZE				
Ford	12.78	14.13	16.27	17.98
Mercury	11.43	13.83	15.16	18.09
Chrysler	14.50	15.15	15.03	18.51
LUXURY PERSONAL				
Buick Riviera	13.36	14.55	16.74	18.77
Oldsmobile Toronado	12.29	16.48	15.79	20.46
Cadillac Eldorado	11.03	15.31	14.45	19.24

* Downsized

TABLE 1-6

COMPANY OUTPUT BY SIZE CATEGORY

	Total Output 1978	Pct. of Company Total	Total Output 1977	Pct. of Company Total	Pct. Pt. Change '78 vs. '77
AMERICAN MOTORS.....	164,351	.....	156.984	.....	.....
Subcompact.....	36 441	22.17	62,986	40.12	-17.95
Compact.....	123,107	74.91	73,572	46.87	+28.04
Intermediate.....	4,803	2.92	20,426	13.01	-10.09
CHRYSLER CORPORATION...	1,126,168	.....	1,236.359	.....	.....
Subcompact.....	288,236	25.60	12,170	0.98	+24.62
Compact.....	428,305	38.03	647,602	52.38	-14.35
Intermediate.....	308,578	27.40	384,898	31.13	- 3.73
Standard.....	101,049	8.97	191,689	15.51	- 6.54
FORD.....	2,557,197	.....	2,555,866	.....	.....
Subcompact.....	343,179	13.42	363,344	14.22	- 0.80
Compact.....	913,808	35.73	723,939	28.33	+ 7.40
Intermediate.....	679,589	26.58	810,798	31.72	- 5.14
Standard.....	431,098	16.86	446,346	17.46	- 0.60
Luxury.....	189,523	7.41	211,439	8.27	- 0.86
GENERAL MOTORS.....	5,261,164	.....	5,339,685	.....	.....
Subcompact.....	611,116	11.62	344,914	6.46	+ 5.16
Compact.....	1,003,219	19.07	1,008,375	18.89	+ 0.18
Intermediate.....	1,821,642	34.62	1,914,004	35.84	- 1.22
Standard.....	1,372,139	26.08	1,600,165	29.97	- 3.89
Luxury.....	453,048	8.61	472,227	8.84	- 0.23
VOLKSWAGEN.....	40,194	.....	.....	.....	.....
Subcompact.....	40,194	100.00	.....	.....	.....
CHECKER.....	4,225	.....	4,780	.....	.....
Standard.....	4,225	100.00	4,780	100.00	.....
TOTAL.....	9,153,299	.....	9,293,674	.....	.....

SOURCE: Automotive News 1979 Market Data Book Issue, April 23, 1979, P. 34.

TABLE 2-1

CANDIDATE PREDICTOR VARIABLES USED IN
ALL PASSENGER CAR BUYER ANALYSES

- Car Attributes
  - Average Number of Cylinders
    - Automatic Transmission
    - Power Brakes
    - Power Steering
    - Air Conditioning
  - Reasons for Buying
    - Percent Indicating Pickup
    - Percent Indicating Mileage
- Evaluative Ratings (1-5 Scale; 1 is Best)
  - Overall Satisfaction
  - Exterior Styling
  - Size/Weight
  - Interior Styling
  - Roominess
  - Ease of Starting
  - Smoothness of Transmission
  - Reliable, Trouble Free
  - Value for Money
- Fuel Economy
  - Miles per Gallon -- City
  - Miles per Gallon -- Highway
  - Percent Indicating Mileage is Better than Expected

TABLE 2-1 (Cont.)

CANDIDATE PREDICTOR VARIABLES USED IN
ALL PASSENGER CAR BUYER ANALYSES

- Background Variables -- Ownership and Demographics
  - Percent Disposing of Current Car at Time of Purchase
  - Number of Cars Currently in Household
  - Number of Trucks Currently in Household
  - Percent Male
  - Percent Married
  - Percent Who are Head of Household
  - Age (Years)
  - Education (Years)
  - Family Size
  - Occupation -- Percent Who Are
    - Managerial, Professional, Technical
    - Other White Collar
    - Blue Collar
    - Other
  - Income ($000's)
  - Number of Wage Earners in Household
  - Locale -- Percent Living in Areas That Are
    - Metropolitan
    - Suburban
    - Small Town
    - Rural/Other

TABLE 2-2

DOWNSIZED 1978 VERSUS 1977 CENTURY --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1978 (N = 293)	1977 (N = 313)
Car Attributes		
Average Number of Cylinders	6.6	7.2
Percent Purchasing:		
Power Brakes	92%	97%
Power Steering	98%	100%
Air Conditioning	83%	94%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Exterior Styling	2.2	2.0
Interior Styling	2.2	2.0
Roominess	2.1	2.6
Smoothness of Transmission	2.5	2.3
Reliable, Trouble Free	2.5	2.7
Fuel Economy		
Miles per Gallon -- City	15.8	15.0
Miles per Gallon -- Highway	20.1	18.8
Background Variables -- Ownership & Demographics		
Number of Trucks in Household	0.4	0.2
Percent Married	87%	73%
Education (Years)	14.4	13.6
Percent Whose Occupation is:		
Other White Collar	20%	30%
Income ($000's)	$26.8	$22.1
Number of Wage Earners in Household	1.3	1.4
Percent Living in Metropolitan Area	20%	30%

87% of the cases are correctly classified by the full set of significant variables.

TABLE 2-3

DOWNSIZED 1978 CUTLASS SALON VERSUS 1977 CUTLASS --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1978 (N = 311)	1977 (N = 112)
Reasons for Buying		
Mileage (Percent)	39%	23%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Exterior Styling	2.2	2.0
Interior Styling	2.2	1.9
Reliable, Trouble Free	2.3	2.6
Value for Money	2.8	2.5
Fuel Economy		
Miles per Gallon -- City	16.3	14.9
Miles per Gallon -- Highway	20.4	18.8
Background Variables -- Ownership & Demographics		
Number of Trucks in Household	0.7	0.2
Percent Who are Head of Household	64%	50%
Age (Years)	48.9	40.9
Education (Years)	14.4	13.7
Number of Wage Earners in Household	1.3	1.5

85% of the cases are correctly classified by the full set of significant variables.

TABLE 2-4

DOWNSIZED 1978 VERSUS 1977 LE MANS --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1978 (N = 289)	1977 (N = 306)
Evaluative Ratings (1-5 Scale; 1 is Best)		
Interior Styling	2.3	2.0
Roominess	2.1	2.4
Reliable, Trouble Free	2.5	2.7
Value For Money	2.9	2.7
Fuel Economy		
Miles Per Gallon -- City	15.7	14.7
Miles Per Gallon -- Highway	19.8	18.7
Background Variables -- Ownership & Demographics		
Number of Cars In Household	1.9	1.6
Number of Trucks In Household	0.5	0.2
Education (Years)	14.6	13.8
Percent Whose Occupation is: Managerial, Professional, Technical	32%	25%
Blue Collar	11%	19%
Income ($000's)	$25.5	$19.9

80% of the cases are correctly classified by the full set of significant variables.

TABLE 2-5

DOWNSIZED 1978 VERSUS 1977 GRAND PRIX --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1978 (N = 260)	1977 (N - 540)
Evaluative Ratings (1-5 Scale: 1 is Best)		
Overall Satisfaction	2.5	2.2
Interior Styling	2.5	1.7
Roominess	2.2	2.4
Smoothness of Transmission	2.4	2.0
Reliable, Trouble Free	2.3	2.6
Value For Money	2.9	2.3
Fuel Economy		
Miles Per Gallon -- City	15.3	14.3
Miler Per Gallon -- Highway	19.4	18.3
Background Variables -- Ownership & Demographics		
Number of Cars Currently In Household	1.9	1.7
Number of Trucks Currently In Household	0.6	0.3
Percent Married	78%	70%
Age (Years)	38.4	36.0
Education (Years)	14.5	13.9
Income ($000's)	$27.5	$22.1
Locale -- Percent Living In Areas That Are Suburban	42%	33%

87% of the cases are correctly classified by the full set of significant variables.

TABLE 2-6

DOWNSIZED 1978 VERSUS 1977 MONTE CARLO --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1978 (N = 257)	1977 (N = 275)
Car Attributes		
Average Number of Cylinders	7.6	7.9
Reasons For Buying: Percent Indicating Mileage	19%	6%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Overall Satisfaction	2.5	2.3
Interior Styling	2.3	1.8
Roominess	2.2	2.5
Smoothness of Transmission	2.3	2.0
Reliable, Trouble Free	2.4	2.8
Value For Money	2.8	2.5
Fuel Economy		
Miles Per Gallon -- City	15.7	14.2
Miles Per Gallon -- Highway	20.0	17.8
Background Variables -- Ownership & Demographics		
Number of Trucks Currently In Household	0.6	0.3
Education (Years)	14.1	13.3
Percent Whose Occupation is: Managerial, Professional, Technical	32%	23%
Blue Collar	18%	28%
Income ($000's)	$23.7	$20.8

87% of the cases are correctly classified by the full set of significant variables.

TABLE 2-7

DOWNSIZED 1979 MUSTANG VERSUS 1978 MUSTANG II --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1979 (N = 127)	1978 (N = 272)
Car Attributes		
Average Number of Cylinders	5.1	5.4
Reasons For Buying: Percent Indicating Pick-up	17%	6%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Exterior Styling	1.5	1.7
Size/Weight	2.2	2.0
Interior Styling	1.9	3.0
Fuel Economy		
Miles Per Gallon -- City	18.1	17.1
Miles Per Gallon -- Highway	22.7	21.4
Percent Indicating Mileage is Better Than Expected	18%	5%
Background Variables -- Ownership & Demographics		
Income ($000's)	$25.7	$21.5
Number of Wage Earners In Household	0.9	1.5

91% of the cases are correctly classified by the full set of significant variables.

TABLE 2-8

DOWNSIZED 1979 VERSUS 1978 CHRYSLER --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1979 (N = 100)	1978 (N = 187)
Car Attributes		
Reasons For Buying:		
Percent Indicating Pick-up	12%	0%
Percent Indicating Mileage	11%	4%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Size/Weight	2.0	1.6
Smoothness of Transmission	2.4	2.1
Fuel Economy		
Miles Per Gallon -- City	14.3	13.0
Miles Per Gallon -- Highway	18.6	16.4
Percent Indicating Mileage is Better Than Expected	22%	7%
Background Variables -- Ownership & Demographics		
Percent Male	63%	81%
Percent Married	92%	88%
Percent Who Are Head of Household	64%	75%
Percent Whose Occupation is: Blue Collar	13%	28%
Number of Wage Earners in Household	0.9	1.3

90% of the cases are correctly classified by the full set of significant variables.

TABLE 2-9

DOWNSIZED 1979 VERSUS 1978 MERCURY --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1979 (N = 114)	1978 (N = 253)
Car Attributes		
Reasons For Buying:		
Percent Indicating Pick-up	10%	2%
Percent Indicating Mileage	7%	2%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Exterior Styling	1.7	1.6
Size/Weight	2.0	1.6
Interior Styling	1.8	1.4
Ease of Starting	1.8	2.3
Fuel Economy		
Miles Per Gallon -- City	14.6	13.0
Miles Per Gallon -- Highway	18.4	16.5
Percent Indicating Mileage is Better Than Expected	18%	6%
Background Variables -- Ownership & Demographics		
Number of Wage Earners In Household	0.6	1.4

87% of the cases are correctly classified by the full set of significant variables.

TABLE 2-10

DOWNSIZED 1979 VERSUS 1978 ELDORADO --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1979 (N = 137)	1978 (N = 168)
Car Attributes		
Reasons For Buying: Percent Indicating Mileage	14%	0%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Size/Weight	1.8	1.6
Interior Styling	1.4	2.1
Ease of Starting	1.6	2.0
Fuel Economy		
Miles Per Gallon -- City	15.6	12.6
Miler Per Gallon -- Highway	19.5	16.0
Percent Indicating Mileage is Better Than Expected	19%	10%
Background Variables -- Ownership & Demographics		
Number of Wage Earners In Household	0.6	1.2

87% of the cases are correctly classified by the full set of significant variables.

TABLE 2-11

DOWNSIZED 1979 VERSUS 1978 RIVIERA --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1979 (N = 104)	1978 (N = 236)
Car Attributes		
Average Number of Cylinders	7.5	7.9
Reasons For Buying:		
Percent Indicating Pick-up	9%	3%
Percent Indicating Mileage	7%	1%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Exterior Styling	1.3	1.7
Size/Weight	1.8	1.5
Interior Styling	1.5	2.0
Fuel Economy		
Miles Per Gallon -- Highway	18.9	17.8
Background Variables -- Ownership & Demographics		
Number of Cars Currently In Household	2.2	1.9
Education (Years)	14.6	14.0
Number of Wage Earners In Household	0.7	1.4
Locale -- Percent Living in Areas That Are Suburban	47%	33%

87% of the cases are correctly classified by the full set of significant variables.

TABLE 2-12

DOWNSIZED 1979 VERSUS 1978 TORONADO --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1979 (N = 138)	1978 (N = 238)
Car Attributes		
Reasons For Buying:		
Percent Indicating Pick-up	9%	1%
Percent Indicating Mileage	9%	0%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Size-Weight	1.8	1.6
Interior Styling	1.5	2.8
Smoothness of Transmission	2.0	1.7
Fuel Economy		
Miles Per Gallon -- City	16.4	13.6
Miles Per Gallon -- Highway	20.2	17.0
Background Variables -- Ownership & Demographics		
Percent Male	69%	79%
Education (Years)	14.9	14.0
Percent Whose Occupation is:		
Blue Collar	11%	21%
Income ($000's)	$38.1	$32.2
Number of Wage Earners In Household	0.8	1.3

89% of the cases are correctly classified by the full set of significant variables.

TABLE 2-13

1979 OMNI AND HORIZON VERSUS
SELECTED NON-DOWNSIZED 1979 SUB-COMPACTS --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	OMNI/HORIZON (N = 254)	NON-DOWNSIZED (N = 451)
Car Attributes		
Average Number of Cylinders	4.1	4.8
Percent Purchasing		
Power Brakes	15%	45%
Power Steering	36%	64%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Overall Satisfaction	2.1	2.5
Exterior Styling	2.2	2.0
Roominess	1.9	2.8
Reliable, Trouble Free	2.3	2.5
Value For Money	2.3	2.5
Fuel Economy		
Miles Per Gallon -- City	24.4	19.0
Miles Per Gallon -- Highway	28.8	23.2
Percent Indicating Mileage is Better Than Expected	28%	14%
Background Variables -- Ownership & Demographics		
Percent Male	63%	51%
Percent Married	81%	57%
Percent Who Are Head of Household	67%	46%
Age (Years)	40.7	33.6
Education (Years)	14.2	13.7
Percent Whose Occupation is: Managerial, Professional, Technical	30%	22%

99% of the cases are correctly classified by the full set of significant variables.

TABLE 2-14

1979 OMNI 024 AND HORIZON TC3 VERSUS
SELECTED NON-DOWNSIZED 1979 SMALL SPECIALTY CARS --
AVERAGE PROFILES ON SELECTED VARIABLES

	OMNI 024 HORIZON TC3 (N = 246)	NON-DOWNSIZED (N = 504)
Car Attributes		
Average Number of Cylinders	4.1	6.8
Percent Purchasing:		
Automatic Transmission	42%	78%
Power Brakes	26%	85%
Power Steering	43%	94%
Air Conditioning	37%	73%
Reasons For Buying:		
Percent Indicating Pick-up	15%	8%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Overall Satisfaction	2.2	2.3
Interior Styling	2.0	1.8
Roominess	2.5	2.8
Smoothness of Transmission	2.5	2.3
Value For Money	2.3	2.6
Fuel Economy		
Miles Per Gallon -- City	25.0	16.3
Miles Per Gallon -- Highway	29.1	20.4
Percent Indicating Mileage is Better Than Expected	31%	16%
Background Variables -- Ownership & Demographics		
Percent Male	61%	49%
Percent Married	65%	53%
Percent Who Are Head of Household	56%	39%

96% of the cases are correctly classified by the full set of significant variables.

TABLE 2-15

DOWNSIZED 1979, 1978, AND 1977 VERSUS
1976 CAPRICE -- AVERAGE PROFILES ON
SIGNIFICANT VARIABLES

	1979 (N = 60)	1978 (N = 131)	1977 (N = 184)	1976 (N = 7
Evaluative Ratings (1-5 Scale; 1 is Best)				
Exterior Styling	1.8	2.0	1.6	1.7
Size/Weight	2.0	2.1	1.8	2.0
Roominess	1.9	2.0	1.7	1.9
Fuel Economy				
Miles per Gallon -- City	14.8	14.3	13.9	12.9
Miles per Gallon -- Highway	18.6	17.9	17.5	15.6
Background Variables -- Ownership & Demographics				
Number of Cars in Household	1.7	1.9	2.1	1.8
Education (Years)	13.2	13.7	13.4	12.6
Percent Whose Occupation is: Managerial, Professional, Technical	27%	32%	28%	25%
Income ($000's)	$30.1	$29.9	$26.4	$20.4

On average, 83% of the cases are correctly classified in comparing 1979, 1978, and 1977, respectively, with 1976 buyers.

TABLE 2-16

DOWNSIZED 1979, 1978 AND 1977 VERSUS
1976 OLDSMOBILE 88, 98 -- AVERAGE PROFILES
ON SIGNIFICANT VARIABLES

	1979 (N = 129)	1978 (N - 249)	1977 (N = 321)	1976 (N = 1
Evaluative Ratings (1-5 Scale; 1 is Best)				
Exterior Styling	1.9	1.9	2.0	1.8
Size/Weight	1.7	1.7	1.8	1.6
Roominess	1.8	2.1	2.1	1.7
Fuel Economy				
Miles per Gallon -- City	16.2	15.0	14.1	12.8
Miles per Gallon -- Highway	20.2	18.9	17.7	16.0
Background Variables -- Ownership & Demographics				
Number of Cars in Household	1.9	2.0	1.9	1.7
Education (Years)	13.6	14.0	13.8	13.7
Percent Whose Occupation is: Managerial, Professional, Technical	35%	37%	38%	32%
Income ($000's)	$30.0	$29.7	$28.0	$27.6

On average, 81% of the cases are correctly classified in comparing 1979, 1978, and 1977, respectively, with 1976 buyers.

TABLE 2-17

DOWNSIZED 1978 MALIBU VERSUS 1977 CHEVELLE --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1979 MALIBU (N = 96)	1978 MALIBU (N = 282)	1977 CHEVELLE (N = 296)
Car Attributes			
Average Number of Cylinders	7.2	7.0	7.7
Percent Purchasing:			
Automatic Transmission	96%	96%	99%
Power Brakes	95%	93%	98%
Air Conditioning	82%	76%	87%
Reasons For Buying			
Mileage (Percent)	35%	33%	15%
Evaluative Ratings (1-5 Scale; 1 is Best)			
Overall Satisfaction	2.3	2.6	2.2
Size/Weight	2.2	2.2	2.1
Interior Styling	2.1	2.2	2.0
Roominess	2.2	2.1	2.3
Smoothness of Transmission	2.4	2.4	2.2
Reliable, Trouble Free	2.3	2.5	2.8
Value For Money	2.8	3.0	2.6
Fuel Economy			
Miles Per Gallon -- City	16.1	16.0	14.2
Miles Per Gallon -- Highway	20.1	19.9	18.0
Background Variables -- Ownership & Demographics			
Number of Cars in Household	1.7	1.8	1.6
Number of Trucks in Household	0.2	0.4	0.2
Education (Years)	14.1	14.1	13.4
Percent Whose Occupation is: Managerial, Professional, Technical	25%	29%	19%
Income ($000's)	$23.7	$22.4	$18.6

On average, 81% of the cases are correctly classified by the full set of significant variables when comparing 1979 and 1978, respectively, with 1977 buyers.

TABLE 2-18

DOWNSIZED 1978 VERSUS 1977 CUTLASS SUPREME --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1979 (N = 146)	1978 (N = 293)	1977 (N = 238)
Reasons For Buying			
Mileage	43%	30%	14%
Evaluative Ratings (1-5 Scale; 1 is Best)			
Exterior Styling	1.7	1.7	2.0
Interior Styling	1.8	2.5	1.8
Roominess	2.1	2.1	2.6
Smoothness of Transmission	2.1	2.4	2.2
Reliable, Trouble Free	2.0	2.2	2.6
Value For Money	2.3	2.7	2.5
Fuel Economy			
Miles Per Gallon -- City	16.8	16.1	14.8
Miles Per Gallon -- Highway	21.0	20.1	18.6
Background Variables -- Ownership & Demographics			
Education (Years)	14.3	14.6	13.8
Percent Whose Occupation is: Managerial, Professional, Technical	32%	35%	24%
Income ($000's)	$31.1	$27.8	$24.5

On average, 82% of the cases are correctly classified by the full set of significant variables when comparing 1979 and 1978, respectively, with 1977 buyers.

TABLE 2-19

DIESEL VERSUS GASOLINE ENGINE BUYERS OF THE
1979 CUTLASS, SUPREME, 88/98, ELDORADO, SEVILLE --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	DIESEL (N = 150)	GASOLINE (N = 682)
Car Attributes		
Reasons For Buying: Percent Indicating Pick-up	22%	8%
Evaluative Ratings (1-5 Scale; 1 is Best)		
Smoothness of Transmission	2.3	2.0
Fuel Economy		
Miles Per Gallon -- City	20.4	15.1
Miles Per Gallon -- Highway	24.7	19.0
Percent Indicating Mileage is Better Than Expected	23%	13%
Background Variables -- Ownership & Demographics		
Percent Male	77%	66%
Percent Married	90%	79%
Percent Who Are Head of Household	74%	66%
Age (Years)	49.3	45.8

95% of the cases are correctly classified by the full set of significant variables.

TABLE 2-20

CANDIDATE PREDICTOR VARIABLES USED IN
PICKUP TRUCK BUYER ANALYSES

- Truck Attributes and Evaluative Ratings (1-5 Scale; 1 is Best)
  - Percent Business Use
  - Exterior Style
  - Interior Style
  - Ease of Starting When Cold
  - Smoothness of Transmission
  - Ease of Handling
  - Roominess
  - Reasons For Buying
    Percent Indicating Durability
    Percent Indicating Mileage
- Fuel Economy
  - Miles per Gallon -- Average City/Highway

TABLE 2-20 (Cont.)

CANDIDATE PREDICTOR VARIABLES USED IN
PICKUP TRUCK BUYER ANALYSES

- Background Variables -- Ownership and Demographics
  - Percent Disposing of Current Truck at Time of Purchase
  - Percent Male
  - Percent Married
  - Age (Years)
  - Education (Years)
  - Family Size
  - Occupation -- Percent Who Are
    - Managerial, Professional, Technical
    - Other White Collar
    - Blue Collar
    - Other
  - Income ($000's)
  - Number of Wage Earners in Household
  - Locale -- Percent Living in Areas That Are
    - Metropolitan
    - Suburban
    - Small Town
    - Rural/Other

TABLE 2-21

1978 BUYERS OF FULL SIZE VERSUS COMPACT TRUCKS --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	FULL-SIZE (N = 2750)	COMPACT (N = 1655)
Truck Attributes and Evaluative Ratings		
(1-5 Scale; 1 is Best)		
Percent Business Use	35%	22%
Ease of Starting When Cold	2.1	1.9
Smoothness of Transmission	2.4	2.2
Roominess	2.0	2.6
Fuel Economy		
Miles Per Gallon -- Average City/Highway	11.7	22.3
Background Variables -- Ownership & Demographics		
Percent Male	97%	94%
Percent Married	82%	75%
Age (Years)	39.5	36.4
Education (Years)	12.4	13.4
Family Size	3.3	2.9
Percent Whose Occupation is: Managerial, Professional, Technical	18%	25%
Other White Collar	7%	13%

97% of the cases are correctly classified by the full set of significant variables.

TABLE 2-22

1979 BUYERS OF FULL SIZE VERSUS COMPACT TRUCKS --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	FULL-SIZE (N = 2973)	COMPACT (N = 2135)
Truck Attributes and Evaluative Ratings (1-5 Scale; 1 is Best)		
Percent Business Use	33%	20%
Ease of Starting When Cold	2.2	1.7
Smoothness of Transmission	2.5	2.2
Roominess	2.2	2.7
Fuel Economy		
Miles Per Gallon -- Average City/Highway	11.8	22.2
Background Variables -- Ownership & Demographics		
Percent Male	97%	93%
Percent Married	84%	79%
Age (Years)	39.8	36.3
Education (Years)	12.5	13.2
Family Size	3.1	2.9
Percent Whose Occupation is: Managerial, Professional, Technical	19%	26%
Other White Collar	8%	13%

94% of the cases are correctly classified by the full set of significant variables.

TABLE 2-23

1978 VERSUS 1979 BUYERS OF FULL SIZE TRUCKS --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	1978 (N = 2750)	1979 (N = 2973)
Truck Attributes and Evaluative Ratings (1-5 Scale; 1 is Best)		
Interior Style	1.9	2.1
Ease of Starting When Cold	2.1	2.2
Roominess	2.0	2.2
Background Variables -- Ownership & Demographics		
Percent Disposing of Current Truck	94%	74%
Income ($000's)	$23.7	$25.9
Family Size	3.3	3.1

Only 54% of the cases are correctly classified by the full set of significant variables. In particular, miles per gallon is not significant between the two model years. In effect, then, no major differences are noted between 1978 and 1979 model-year buyers.

TABLE 2-24

DIESEL VERSUS GASOLINE ENGINE BUYERS OF THE
1979 CHEVROLET C-10 TRUCK --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	DIESEL (N = 124)	GASOLINE (N = 281)
Truck Attributes and Evaluative Ratings (1-5 Scale; 1 is Best)		
Percent Business Use	46%	25%
Ease of Handling	1.6	1.9
Fuel Economy		
Miler Per Gallon -- Average City/Highway	19.0	14.1
Background Variables -- Ownership & Demographics		
Percent Male	100%	96%
Age (Years)	45.9	40.4
Income ($000's)	$30.2	$23.8

89% of the cases are correctly classified by the full set of significant variables.

TABLE 2-25

1978 BUYERS OF CARGO VANS, PASSENGER VANS, AND UTILITY VEHICLES -- AVERAGE DEMOGRAPHIC PROFILES ON SIGNIFICANT VARIABLES

DEMOGRAPHIC ATTRIBUTE	CARGO VANS (N = 237)	PASSENGER VANS (N = 494)	UTILITY VEHICLES (N = 494)
Percent Male	96%	92%	94%
Percent Married	89%	96%	85%
Family Size	3.2	3.8	3.4
Age (Years)	37.1	42.9	38.3
Education (Years)	13.2	13.4	13.2
Percent Whose Occupation Is:			
Managerial, Professional, Technical	29%	21%	34%

59% of the cases are correctly classified by the full set of significant variables.

TABLE 2-26

1979 BUYERS OF CARGO VANS, PASSENGER VANS, AND UTILITY VEHICLES -- AVERAGE DEMOGRAPHIC PROFILES ON SIGNIFICANT VARIABLES

DEMOGRAPHIC VARIABLES	CARGO VANS (N = 269)	PASSENGER VANS (N = 258)	UTILITY VEHICLES (N = 446)
Percent Male	93%	94%	91%
Percent Married	84%	95%	85%
Family Size	3.1	3.6	3.3
Age (Years)	39.2	42.6	39.1
Education (Years)	13.4	13.7	13.2
Percent Whose Occupation Is:			
Managerial, Professional, Technical	28%	41%	35%

59% of the cases are correctly classified by the full set of significant variables.

TABLE 2-27

1978 BUYERS OF CLASS I VERSUS CLASS II VEHICLES --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

		CLASS I (N = 1552)	CLASS II (N = 192)
Truck Usage			
Used Primarily For Business	(Percent)	17%	44%
Used For Delivery Service	(Percent)	8%	16%
Used For Construction	(Percent)	9%	20%
Used For Repair Service	(Percent)	5%	9%
Percentage of Time In Personal Use		76%	49%
Used To Pull Trailers 3 = Frequently 2 = Occasionally 1 = Never		1.5	1.7
Passenger Carrying Capacity is Too Small	(Percent)	11%	7%
Expected Mileage		17.3	13.4
Background Variables			
Number of Trucks in Household		1.4	1.9
Percent Male		95%	99%
Percent Married		83%	92%
Age (Years)		38.0	41.6
Percent Whose Occupation Is: Managerial, Professional, Technical		27%	19%
Income ($000's)		$22.2	$23.8
Number of Wage Earners In Household		1.2	1.0

76% of the cases are correctly classified by the full set of significant variables.

TABLE 2-28

1979 BUYERS OF CLASS I VERSUS CLASS II VEHICLES --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

		CLASS I (N = 1780)	CLASS II (N = 220)
Truck Usage			
Purchased With Business Use In Mind	(Percent)	31%	62%
Used For Personal Transportation	(Percent)	86%	53%
Used For Outdoor Recreation	(Percent)	61%	39%
Used For Delivery of Cartages	(Percent)	8%	19%
Used In Ranching, Agriculture	(Percent)	11%	18%
Used In Services	(Percent)	8%	15%
Used In Wholesale, Retail Trade	(Percent)	7%	14%
Used Primarily For Personal Use	(Percent)	55%	20%
Percentage of Time In Personal Use		77%	50%
Used To Pull Trailers 3 = Frequently 2 = Occasionally 1 = Never		1.4	1.7
Passenger Carrying Capacity is Too Small	(Percent)	16%	7%
Expected Mileage		17.0	12.6
Background Variables			
Age (Years)		38.7	41.4

80% of the cases are correctly classified by the full set of significant variables.

TABLE 2-29

1978 BUYERS OF TWO-WHEEL VERSUS FOUR-WHEEL DRIVE --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

	TWO-WHEEL DRIVE (N = 1154)	FOUR-WHEEL DRIVE (N = 590)
Truck Usage		
Used For Farming (Percent)	9%	14%
Used For Off-Road Travel 3 = Frequently 2 = Occasionally 1 = Never	1.6	2.1
Cargo Carrying Capacity Is Too Small (Percent)	5%	9%
Passenger Carrying Capacity Is Too Small (Percent)	13%	7%
Expected Mileage	18.1	14.3
Background Variables		
Percent Married	86%	79%
Age (Years)	39.3	36.6
Education (Years)	13.1	12.8
Income ($000's)	$21.6	$23.7

76% of the cases are correctly classified by the full set of significant variables.

TABLE 2-30

1979 BUYERS OF TWO-WHEEL VERSUS FOUR-WHEEL DRIVE --
AVERAGE PROFILES ON SIGNIFICANT VARIABLES

		TWO-WHEEL DRIVE (N = 1398)	FOUR-WHEEL DRIVE (N = 602)
Truck Usage			
Used For Outdoor Recreation	(Percent)	55%	65%
Used For Farming	(Percent)	10%	17%
Used For Off-Road Travel 3 = Frequently 2 = Occasionally 1 = Never		1.6	2.1
Expected Mileage		17.4	14.4
Background Variables			
Percent Married		85%	81%
Age (Years)		39.8	37.3
Income ($000's)		$25.2	$27.8

77% of the cases are correctly classified by the full set of significant variables.

TABLE 3-1

SIMILARITIES MAP OF 1976 CAR SEGMENTS

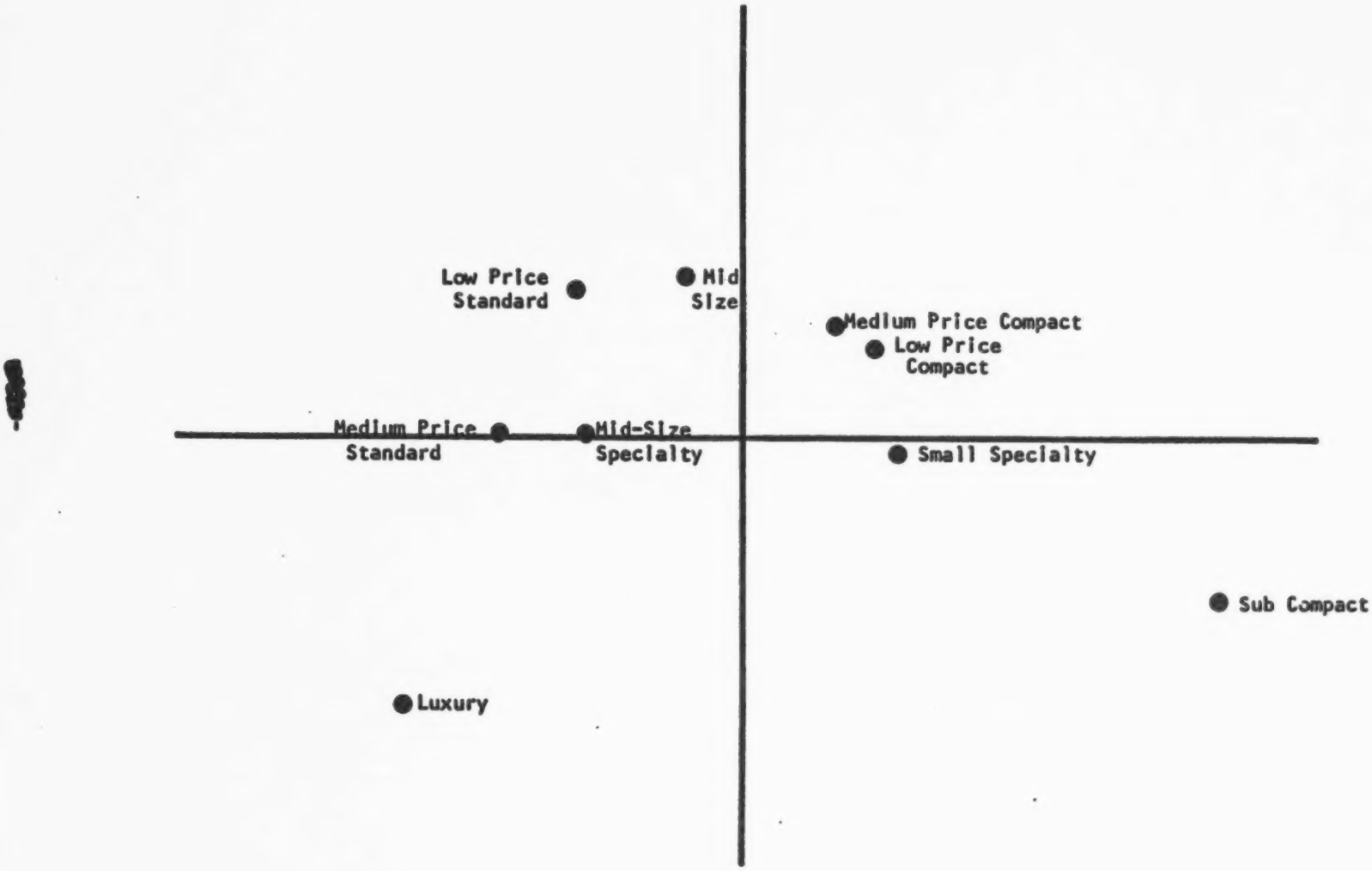

TABLE 3-2

SIMILARITIES MAP OF 1977 CAR SEGMENTS

TABLE 3-3

SIMILARITIES MAP OF 1978 CAR SEGMENTS

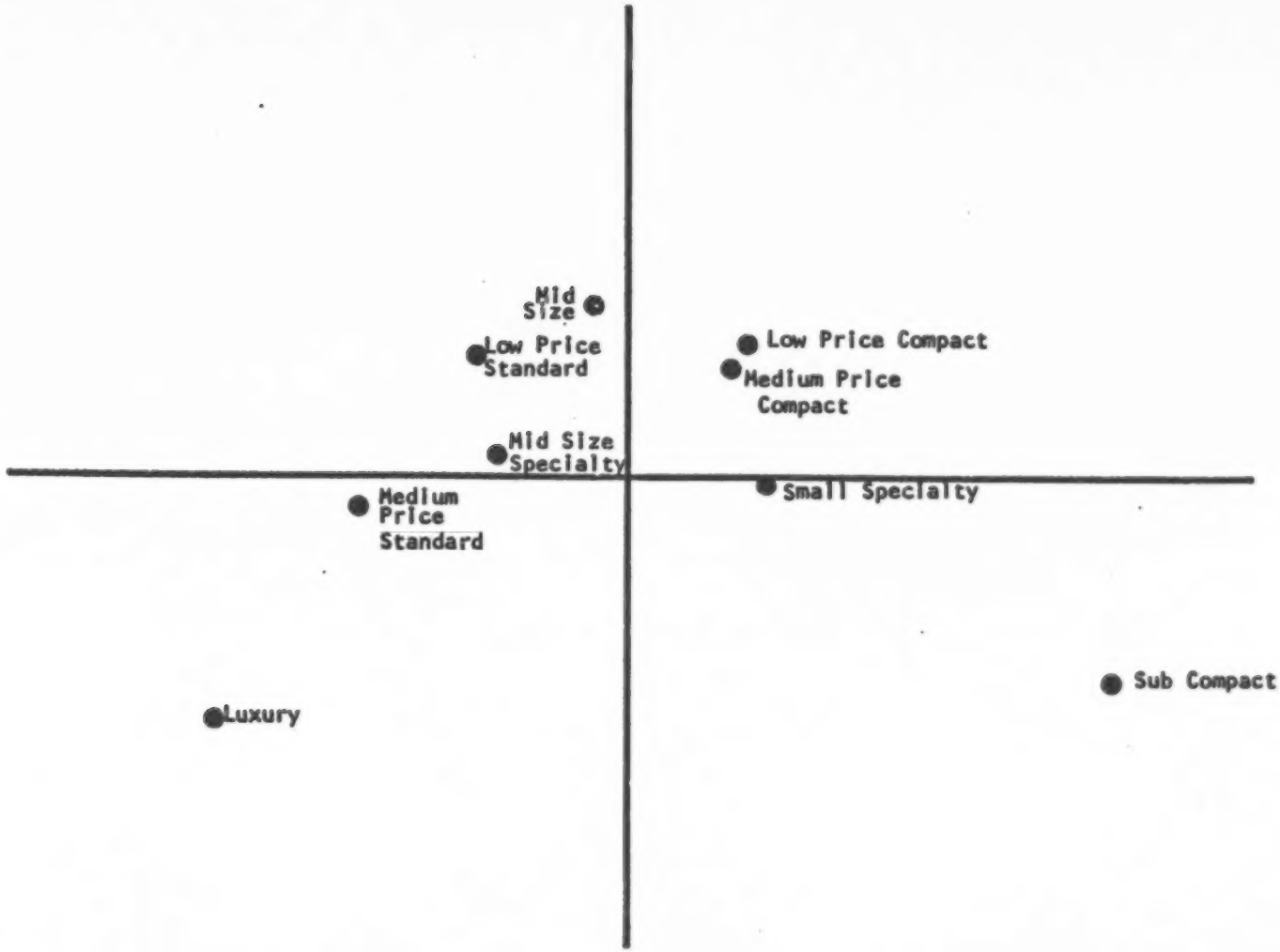

TABLE 3-4

SIMILARITIES MAP OF 1979 CAR SEGMENTS

TABLE 4-1

NEW CAR REGISTRATIONS

JANUARY THRU SEPTEMBER
1977 AND 1978

Segment	1977 Number	1977 Segment Share	1978 Number	1978 Segment Share
Subcompact	311,816	4.2	452,171	6.0
Compact	1,730,079	23.4	1,877,844	25.1
Intermediate	2,001,321	27.0	1,936,560	25.9
Standard	1,387,471	18.8	1.282,257	17.1
Luxury Personal	67,307	0.9	62,607	0.8
Luxury Specialty	89,380	1.2	89,502	1.2
Luxury Standard	266,187	3.6	276,814	3.7
Total Domestic	5,853,561	79.1	5,977,755	80.0
Total Import	1,544,159	20.9	1,498,515	20.0
* Total Passenger	7,397,720	100.0	7,476,270	100.0

* Excludes station wagons, vans, van wagons.

Source: Automotive News, November 27, 1978, p. 56 based on R. L. Polk & Co. statistical report.

TABLE 4-2

INTERMEDIATE SEGMENT NEW CAR REGISTRATIONS

JANUARY THRU SEPTEMBER
1977 AND 1978

INTERMEDIATE	1977 Number	1977 Segment Share	1978 Number	1978 Segment Share
GENERAL MOTORS				
* Buick Century	72,088	3.6	32,555	1.7
* Buick Regal	126,670	6.3	176,353	9.1
* Chevrolet Malibu	170,143	8.5	199,721	10.3
* Chevrolet Monte Carlo	280,480	14.0	261,704	13.5
* Olds Cutlass Salon	110,121	5.5	51,126	2.6
* Olds Cutlass Supreme	274,860	13.7	289,876	15.0
* Pontiac LeMans	41,881	2.1	67,406	3.5
* Pontiac Grand Prix	188,739	9.4	157,579	8.1
TOTAL GM INTERMEDIATE	1,264,982	63.2	1,236,320	63.8
FORD MOTOR COMPANY				
Ford LTD II	132,325	6.6	116,728	6.1
* Ford Thunderbird	233,555	11.7	237,237	12.2
Mercury Cougar	132,382	6.6	148,177	7.7
TOTAL FORD MOTOR COMPANY	498,262	24.9	504,142	26.0
CHRYSLER CORPORATION				
Chrysler Cordoba	105,790	5.3	79,628	4.1
Plymouth Fury	58,906	2.9	46,823	2.4
Dodge Monaco	39,950	2.0	27,204	1.4
Charger SE/Magnum XE	22,440	1.1	37,125	1.9
TOTAL CHRYSLER	227,086	11.3	190,780	9.9
AMC Matador	10,991	0.5	5,318	0.3
TOTAL INTERMEDIATE	2,001,321	100.0	1,936,560	100.0

* Downsized in 1978

Source: Automotive News, November 27, 1978, p. 56 based on R. L. Polk & Co. statistical report.

TABLE 4-3

NEW CAR REGISTRATIONS

JANUARY THRU SEPTEMBER
1978 AND 1979

Segment	1978 Number	1978 Segment Share	1979 Number	1979 Segment Share
Subcompact	452,171	6.0	665,249	9.2
Compact	1,877,844	25.1	1,846,723	25.5
Intermediate	1,936,560	25.9	1,479,260	20.4
Standard	1,282,257	17.1	1,061,768	14.7
Luxury Personal	62,607	0.8	119,090	1.6
Luxury Specialty	89,502	1.2	77,201	1.1
Luxury Standard	276,814	3.7	225,699	3.1
Total Domestic	5,977,755	80.0	5,474,990	75.6
Total Import	1,498,575	20.0	1,768,187	24.4
* Total Passenger	7,476,270	100.0	7,243,177	100.0

* Excludes station wagons, vans, van wagons.

Source: Automotive News, November 19, 1979 based on R. L. Polk & Co. statistical report.

TABLE 4-4

STANDARD SIZE SEGMENT NEW CAR REGISTRATIONS

JANUARY THRU SEPTEMBER
1978 and 1979

	1978		1979	
	Number	Segment Share	Number	Segment Share
GENERAL MOTORS				
Buick LeSabre	125,381	9.8	89,309	8.4
Buick Electra	85,701	6.7	62,955	5.9
Chevrolet Impala	164,741	12.8	124,901	11.8
Chevrolet Caprice	183,935	14.3	141,422	13.3
Olds Delta 88	176,466	13.8	153,581	14.5
Olds 98	82,076	6.4	67,117	6.3
Pontiac Catalina	37,031	2.9	19,713	1.9
Pontiac Bonneville	93,308	7.3	94,375	8.9
TOTAL GM STANDARD	948,639	74.0	753,373	70.9
FORD MOTOR COMPANY				
*Ford LTD	184,493	14.4	157,308	14.8
*Mercury Marquis	95,456	7.4	61,325	5.8
TOTAL FORD STANDARD	279,949	21.8	218,633	20.6
CHRYSLER CORPORATION				
*Chrysler Newport	24,564	1.9	43,651	4.1
*Chrysler New Yorker	27,811	2.2	24,501	2.3
Dodge St. Regis	8	-	21,598	2.0
Plymouth Fury	1,286	0.1	-	-
TOTAL CHRYSLER STANDARD	53,669	4.2	89,750	8.4
TOTAL STANDARD	1,282,257	100.0	1,061,756	100.0

Source: Automotive News, November 19, 1979 based on R. L. Polk & Co. statistical report.

TABLE 4-5

NEW CAR REGISTRATIONS LUXURY CAR SEGMENTS

JANUARY THRU SEPTEMBER
1978 AND 1979

	1978		1979	
GENERAL MOTORS	Number	Segment Share	Number	Segment Share
* Buick Riviera	14,060	3.3	37,941	9.0
* Oldsmobile Toronado	16,978	3.9	34,947	8.3
Cadillac DeVille	148,215	34.5	123.204	29.2
Cadillac Fleetwood	25,445	5.9	25.411	6.1
Cadillac Seville	37,577	8.8	30,310	7.2
* Cadillac Eldorado	31,569	7.4	46,202	10.9
Corvette	29,491	6.9	29,662	7.0
TOTAL GENERAL MOTORS	303,335	70.7	327,677	77.7
FORD MOTOR COMPANY				
Lincoln Continental	65,577	15.3	46,774	11.1
Lincoln Versailles	9,511	2.2	10,427	2.4
Continental Mark V	50,500	11.8	37,112	8.8
TOTAL FORD MOTOR COMPANY	125,588	29.3	94,313	22.3
TOTAL LUXURY SEGMENTS	428,923		421,990	

* Downsized in 1979

Source: Automotive News, November 19, 1979 based on R. L. Polk & Co. statistical report.

TABLE 4-6

NEW CAR REGISTRATIONS

1976 - 1979

	1976	1977	1978	1979
AMC	2.53%	1.69%	1.44%	1.52%
Chrysler Corporation	13.69	12.05	11.09	10.32
Ford Motor Company	22.77	23.20	23.65	21.04
General Motors	47.32	46.63	47.84	46.61
Misc. Domestic	.05	.05	.04	.04
Other Import	13.64	16.38	15.94	20.47
U. S. Total	100.00%	100.00%	100.00%	100.00%

Source: R. L. Polk & Co. registration statistics

APPENDIX

REPORT OF NEW TECHNOLOGY

The work performed under this contract, while leading to no new technology, has led to an analysis of consumer automotive preference with regard to fuel economy.